April 25, 1872.

GEORGE BIDDELL AIRY, C.B., President, in the Chair.

The following communications were read :—

I. "Contributions to Formal Logic." By ALEXANDER J. ELLIS, F.R.S., F.C.P.S., F.S.A., &c. Received March 21, 1872.

(Abstract.)

This paper contains the following contributions to Formal Logic :—

Statement of the Problem of Deductive Logic, with a classification of its cases.

Method of solution for three principal cases, of which the second has not been hitherto formally considered.

New notation and calculus of logical relations.

New system of diagrams, adapted for typography, and coextensive with the system of notation for cases of composition.

Purely logical solution of all the problems within the scope of Boole's system, with complete results, and without his mathematical analogies or hazardous theories, with a proof that his primary and secondary propositions only partially, and not, as he assumes, wholly obey the same laws.

Fusion of Hamilton's judgments and De Morgan's propositions, as part of one system of assertions.

Exhaustive analysis of the syllogism.

Re-cast of the theory and notation of De Morgan's numerically definite assertions, as the general case of the logic of composition, and a legitimate application of algebra to logic.

Direct passage from the purely logical formulæ of consistency to the mathematical formulæ of Boole's system of probabilities.

The above contributions are believed to be entirely original, and are given with the least possible restatement of former theories; but, for convenience, frequent reference has been made to Boole, De Morgan, Thomson as representing Hamilton, Ueberweg, and Jevons. Boole and De Morgan have been constantly before my mind, and whatever is common to this paper and their works must be credited to them. Jevons first led my thoughts in this direction, but all resemblance between us is entirely superficial.

The problem of deductive logic as here conceived is :—*Given any assertions, to determine precisely what they affirm, precisely what they deny, and precisely what they leave in doubt, separately and jointly.*

Assertions have respect to *Coexistence* or *Succession*, or both.

COEXISTENCE generates:

Composition, arising from the coexistence of different attributes in the same thing, and the coexistence of the same attribute in different things;

Combination, arising from the coexistence of different things, objectively or subjectively, in the same aggregate;

Consistency, arising from the coexistence of different events affirmed by different assertions.

Succession generates: *Logical inference, Sequence in Space, in Time, and in Action.*

Mixed cases arise from combining assertions of different kinds.

Composition, combination, and consistency only are considered in the present paper. Composition constitutes the primary, and consistency the secondary propositions of Boole. Combination has not been distinctly recognized in logical works, but is constantly implied in Boole's and De Morgan's treatments of Composition, whereby its real character has been overlooked. Logical Inference is partially considered in the treatment of Composition, Combination, and Consistency. Sequence in Space, Time, and Action is not treated at all.

Thomson's, De Morgan's, and Boole's notations are carefully interpreted. Particular attention is paid to Boole's results for Consistency, and the nature of the error which he committed in accommodating those results to Composition, together with the value of his accommodated results, is exactly determined. The ascertainment of these errors by a fundamental reconsideration of the bases of the relations of Composition and Consistency, and a purely logical method of obtaining precise results, forms the distinctive character, as it was the special object, of the present investigation.

II. "On a supposed Periodicity in the elements of Terrestrial Magnetism, with a period of $26\frac{1}{3}$ days." By George Biddell Airy, Astronomer Royal. Received March 26, 1872.

In a paper published in the 'Proceedings of the Imperial Academy of Sciences of Vienna,' vol. lxiv., Dr. Karl Hornstein has exhibited the results of a series of observations which appeared to show that the earth's magnetism undergoes a periodical change in successive periods of $26\frac{1}{3}$ days, which might with great plausibility be referred to the rotation of the sun.

It appeared to me that the deductions from the magnetic observations made at the Royal Observatory of Greenwich, and which are printed annually in the 'Greenwich Observations,' or in the detached copies of 'Results of Magnetical and Meteorological Observations made at the Royal Observatory of Greenwich,' would afford good materials for testing the accuracy of this law, as applicable to a series of years. The mean results of the measured hourly ordinates of the terrestrial magnetic elements are given for every day, and it is certain that there has been no change of adjustments of the declination and horizontal-force instruments in the course of each year. For the horizontal-force instrument the tem-